Remarks

Claims 11 through 23 stand rejected under 35 USC 103(a) as being unpatentable over Gottwald '722 in view of Oswald '633. In responding to these rejections, the Applicant has entered new independent claims 24 and 25 and cancelled former claims 11 and 14. The dependent claims have been amended for consistency therewith.

Independent method claim 24 recites steps of operating the first partial antenna to radiate and subsequently detect first signals having a first broad directional dependence and operating a second partial antenna to radiate and subsequently detect second signals having a second broad directional dependence with a notch of missing or reduced intensity within a narrow angular region. These steps are cyclically repeated. Subsequent thereto, the second detected signals are subtracted from the first detected signals to generate a third directional dependence which is substantially narrower than the first directional dependence and than the second directional dependence. Claim 25 has been amended accordingly using means for function language consistent with method claim 24. The Applicant respectfully submits that the claims as amended are sufficiently distinguished from the prior art of record for the following reasons.

Gottwald '722 discloses an antenna system for pulse radar applications having antennas whose directional characteristics can be switched with regard to direction as well as width. In order to achieve a narrow directional dependence, two additional columns of antenna patches 21, 22 are added to a first antenna column 2 (figure 9 as well as column 2 lines 35 through 37 of Gottwald). The narrow radiation angular dependence is caused by the additional columns. The columns are thereby operated simultaneously. Therefore, the narrow directional dependence of Gottwald is effected through simultaneous operation of a plurality of columns of partial antennas in combination with the physical superposition of the

antenna signals. In the irradiation process, this superposition comprises interfering irradiation fields and, during the receiving process, receiving signals that arrive at different patches (i.e. different parts of the antenna are added in the form of currents and/or voltages in the subsequent signal processing stage). As is known in the art, the width and the angular dependence decrease as the number of columns of patches are increased, when those patches are driven in a correlated fashion. The '722 patent proposes three columns 22, 21, and 2 in order to achieve a rough angular resolution for one single sensor (see '722 column 2 penultimate line). The width of the lobes generating according to Gottwald decreases with an increasing number of irradiation columns. Therefore, in order to achieve very narrow radiation lobes it is necessary to utilize a relatively large number of columns. This, in turn, requires additional space and is expensive, both of which are disadvantageous.

In contrast thereto, the invention as now claimed achieves a narrow lobe (a narrow angular dependence) in a completely different manner. In accordance with claim 24, two partial antennas are not operated simultaneously rather are varied in a cyclic fashion. Each of the partial antennas thereby has a relatively broad directional dependence (field of view or lobe structure) either in the transmit and/or in the receive operation. The second partial antenna is operated in such a fashion that its directional dependence exhibits a notch or angular region of decreased intensity. In a preferred embodiment, this notch is achieved through the electrical separation when controlling the two columns of the second antenna system (i.e. by operating the two columns with a predetermined phase difference). The signals of both columns that relate to a certain area in the field of view will then cancel (or attenuate) each other, resulting in the notch. This effect can be achieved in both the transmit and the receive mode. The notch is relatively narrow and corresponds essentially to a blind spot or spot of reduced sensitivity within the angular range dependence of the second partial antenna, i.e. within the field of

view of the second partial antenna. The directional dependence of the first partial antenna is similarly broad but does not have a notch or region of reduced intensity.

The signal operation and detection of the two partial antennas and the subsequent subtraction of the antenna signals which are generated thereby has the following effects as illustrated by two possible cases

1.) Consider an object which is located within the broad directional dependence of both partial antennas and therefore, in particular, outside of the blind or notch region of the second partial antenna. For such a case, the object is seen by both partial antenna systems and influences the antenna signals received in each partial antenna. Subtraction of the two partial antenna signals (radar echoes) then leads to mutual cancellation (through subtraction) of the radar signals from the first and second partial antennas during signal processing. In consequence thereof, the object is not seen by the overall radar sensor.

2.) Consider the case in which a object is located within the broad directional dependence of both partial antennas and also within the blind spot of the second partial antenna. In this case, only the first partial antenna contains echo information concerning the object in its received of signals. When the signals of the two partial antennas are subtracted, the negative opposing signal is missing from the second partial antenna. The subtraction procedure therefore results in the portion of the radar echo signal coming from the first partial antenna surviving the subtraction process. As a result thereof, the object is seen by the combined radar sensor signals. In general, the radar sensor system therefore only sees the object when it is located in the blind or notch region of the second partial antenna.

This blind region corresponds to the notch recitation in the directional dependence and is relatively narrow.

Therefore, the entire radar system generates a narrow directional dependence through the subtraction process which can be effected using less antenna columns and therefore with smaller amounts of space and lower cost than in the system due to Gottwald '722.

With regard to the Oswald reference '633, no suggestion is made by Oswald for a system in which the first and second partial antennas are operated with each of the partial antenna systems having a broad directional dependence. Moreover, neither of the partial antenna systems has a notch in the directional dependence. In addition, neither Oswald nor Gottwald suggest a subtraction process between the two antenna signals.

The invention as claimed in claims 21 and 24 recites features not disclosed by the prior art of record having associated advantages and is therefore sufficiently distinguished from that prior art to satisfy the conditions for patenting in the United States. The dependent claims inherit the limitations of respective base claims and are therefore similarly distinguished from the prior art of record for the reasons given. Passage to issuance is therefore respectfully requested.

No new matter has been added in this amendment.

Respectfully submitted,

Paul Vincent

Dr. Paul Vincent

Registration number 37,461

Feb 05, 2008

Date

Dreiss, Fuhlendorf, Steimle & Becker
Patentanwälte
Postfach 10 37 62
D-70032 Stuttgart, Germany
Telephone +49-711-24 89 38-0
Fax +49-711-24 89 38-99